Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

righteousness, truth, and wisdom, as the chief good by enlisting the good offices of unseen beings in the unseen world."[1] Religion should be carefully distinguished from beliefs about religion. Most of the attacks aimed at religion have been in reality directed against theology. The editor of this journal advocates with great earnestness and intelligence, a religion of science, but in the sense in which I use the term religion, and which, in my judgment, is the correct meaning when speaking of its origin, there can be no such thing. What is really meant is that the beliefs growing out of religion should be purified by science; that is, that there should be a science of religion rather than a religion of science. Religion, traced back to its origin, is the recognition on the part of primitive men, or of members of sub-human species, that there were powers or agents outside of themselves which might help them or harm them, and the desire to be in right relation with these agencies. The desire arose from fear of agencies which, by the primitive mind, were interpreted as spiritual, and the hope of propitiating these agents led to acts of worship. Religion appearing in the individual was through a sort of principle of spontaneous variation laid hold of by the social group and utilised in the construction of religious systems. Knowledge and belief, hope and desire, are all, then, at the basis of religion.

If this conception of religion is correct, the theory proposed by Dr. Brinton in his study of primitive religions is deficient in that it not only gives a poor explanation of the phenomena which it starts out to explain, but it also seeks to explain a phenomenon which is not religion. I. W. Howerth.

University of Chicago.

A STRANGE ATTACK ON SOME PHYSICAL THEORIES.

In the October, 1899, number of *The Monist* appeared an article by the Hon. Chas. H. Chase on "The Doctrine of Conservation of Energy in Its Relation to the Elimination of Force as a Factor in the Cosmos." The writer's main object is to show that all energy cannot be explained, or expressed, in terms of motion, and that force cannot be identified with kinetic energy. Whatever the validity of these theories may be (and they are certainly not original with Mr. Chase), I would like to call attention to some of the mathematical reasoning by which Mr. Chase claims to have established them beyond all doubt.

He starts his mathematical "demonstrations" by telling us that, in the collision of two inelastic bodies of masses m and m', moving with velocities v and v', the momentum M and the kinetic energy E, before collision, are given by the formulas, $M = mv + m'v'$, and $E = \frac{1}{2}mv^2 + \frac{1}{2}m'v'^2$; and, after collision, by the formulas, $M' = \frac{1}{2}(m + m')(v + v')$, and $E' = \frac{1}{2}(m + m')\frac{(v + v')^2}{4}$. He says that, according to these formulas, the quantity of motion remains unchanged by the collision, whereas the kinetic energy will "in general be different in magnitude, and $E > E'$"; that, by collision, therefore, some energy "disappears," but "motion" is "conserved"; that the energy E' is due to the total motion of the system, and that, therefore, if there is any potential energy, this energy cannot be due to motion, but must be due to force. All this line of argument he prefaces by saying that the theory that potential energy is a form of motion is an "obvious error," and that "the (mathematical) demonstration of the impossibility of such a position is so simple," that he is surprised to see that it has escaped the attention of expert mathematicians.

---

[1] Major Powell in *The Monist*, January 1898, p. 187.

It will be seen that Mr. Chase has not concerned himself very much about splitting hairs. He has cut the Gordian knot by applying the all-powerful and most "practical" method of *averages*. To find the velocity of the impinging bodies after impact he simply takes the *mean* of their velocities before impact. This done, the rest might be expected to follow smoothly, according to mathematical principles. But even here Mr. Chase seems to have ideas of his own. He tells us that, *according to the formulas*, there is no loss of momentum; that is, we must have, $M = M'$, or $mv + m'v' = \frac{1}{2}(m + m')(v + v')$. It is easy to transform this equation and reduce it to the form, $m(v - v') = m'(v - v')$, and this requires that we should have either $m = m'$, or $v = v'$, or both $m = m'$ and $v = v'$. Mr. Chase's first unsuspected discovery is, therefore, when properly "generalised," that *all the bodies in the universe have either the same mass or the same velocity, or both the same mass and the same velocity.*

The other equation, $E' = \frac{1}{2}(m + m')\frac{(v + v')^2}{4}$, leads to an equally interesting and astounding conclusion. Suppose m' to be originally at rest. Then $v' = 0$, and E' may be made as great as desired by increasing m'; and, since E is in this case independent of m', the difference $E' - E$ may be made as great as we please. That is, we may *create* any amount of energy. The application of this "new principle" to the vexed problem of perpetual motion is a simple question of mechanism. The second discovery of Mr. Chase is, therefore, that *with any amount of kinetic energy* ($\frac{1}{2}mv^2$), *however small, we may* CREATE *an unlimited amount of energy of the same kind.* This "law" can be applied in "practice" with most wonderful results. Thus, a 10,000-ton man-of-war, hit from beneath by a bullet weighing 2 or 3 ounces, could easily be hurled up into the air with a velocity of 1000 feet per second.

Of course, it is scarcely necessary for me to say that Mr. Chase's great error consists in assuming the velocity after collision to be a mean between the velocities before collision. It is well known that the final velocity is $M/(m + m')$, and that the final *molar* kinetic energy is $E - \frac{1}{2}\frac{mm'}{m + m'}(v - v')^2$.

Mr. Chase further concludes, from some simple mechanical formulas the exact meaning of which does not seem to be very plain to him, that "it is evident that kinetic energy is not wholly dependent on matter and motion." Mr. Chase will not, we hope, accuse us of promulgating "errors" and "absurdities" if we tell him that, *by definition*, kinetic energy is energy due to motion; indeed, the term is often defined by mathematicians as a name given to the product $\frac{1}{2}mv^2$. What would a mechanician say to any one who told him that the velocity of a moving body does not depend upon time and space?

Prof. C. L. Morgan referred somewhere to the arguments of some vitalists, founded on the principle that a force acting constantly in a direction normal to the path of a moving particle cannot alter the kinetic energy of the particle. This is a well-known principle of dynamics, and is found in every elementary text-book. Mr. Chase, however, takes the Professor and the vitalists to task, and says: "The vitalists to whom Professor Morgan refers were ignorant of mechanics, or he has misquoted them; and in either case he seems not to have discovered the mathematical absurdity involved." To expose this "absurdity," Mr. Chase assumes a particle moving in a straight line with a velocity a. When the particle is at a certain point, a force is "impressed" on it "sufficient to give it a velocity b," the direction of the force being normal to the path of the particle. He draws a parallelogram whose sides are a and b, and says that the resultant motion will be in the direction of the diagonal, with a velocity equal to $\sqrt{a^2+b^2}$. The kinetic energy of the particle, after the action of the force, will be $\frac{1}{2}m(a^2+b^2)$; that is, the force has increased that kinetic energy by an amount equal to $\frac{1}{2}mb^2$, and this is contrary to the principle maintained by (or wrongly attributed by Professor Morgan to) the vitalists.

Here again Mr. Chase seems to be somewhat confused. The principle in question affirms that a force does no work (this being another name for change of energy) when the path of its point of application *remains* normal to the direction of the force while the force acts. In the present case, we have an unconstrained particle, which, on being acted upon by the impressed force, leaves its rectilinear path and moves in the arc of a parabola (not in a straight line, as Mr. Chase seems to think). While the force acts, it is no longer normal to the path of the particle, and does an amount of work whose measure is obtained by projecting the path on the line of action of the force, and multiplying the projection by the magnitude of the force. Perhaps Mr. Chase was thinking of an impact when he spoke of an "impressed force"; but this does not alter the general principle, the only difference being that here the force acts through a very short distance.

ANTONIO LLANO.